REMARKS

Upon entry of this amendment, claims 15-40 are pending.

In the April 1, 2003 Office Action, the proposed drawing correction has been disapproved because in the Examiner's opinion the new FIGS. 7 and 8 introduce new matter. Claims 15-20, 25 and 40 were rejected under 35 U.S.C. § 102(b) as being anticipated by Genov et al (US 5,064,340). Claims 21-24 and 26-39 were rejected under 35 U.S.C. 103(a) as being unpatentable over Genov et al (US 5,064,340) in view of Parker (US 5,934,147). Applicant is of the opinion that the new drawings do not introduce new subject matter and that Genov et al does not anticipate claims 15-20, 25 and 40 and that Genov et al in view of Parker do not make claims 21-24 and 26-39 obvious. Applicant respectfully requests the following arguments to be considered:

Drawings

In the April 1, 2003 Office Action, the proposed drawing correction has been disapproved because in the Examiner's opinion the new FIGS. 7 and 8 introduce new matter. Applicant does not agree for the following reasons:

Claims 9 - 16 filed with the original application claimed "*Semi-conductor mounting means according to claim ..., characterised in that the second pivoted lever is seated on a shaft upon which a toothed wheel is seated, which is driven by a toothed wheel fixed on and coaxial to the drive shaft via a toothed belt or an intermediate wheel mounted on the first pivoted lever.*"

The description as originally filed disclosed on page 5, third paragraph, "*(Instead of the toothed belt 6, an intermediate toothed wheel mounted on the lever 12, which meshes with the toothed wheels 5 and 7, could be provided).*" The use of the numeral 12 for the lever was an error. A person skilled in the art easily recognizes this error because the intermediate wheel must be mounted on the first pivoted lever 10, otherwise it cannot replace the toothed belt 6 running between the toothed wheels 5 and 7 located at the ends of the first pivoted lever 10. In the original claims 9 - 16 it has been correctly stated that the intermediate wheel is mounted on the first pivoted lever, which in the description carries the numeral 10.

For these reasons, Applicant requested replacement of the erroneous numeral 12 by the correct numeral 10, and the acceptance of the new FIGS. 7 and 8 in the response to the last Office Action. For these reasons, Applicant is of the opinion, that the new FIGS. 7 and 8 do not introduce new matter and requests that the new FIGS. 7 and 8 together with the corresponding amendments in the description be allowed.

The 35 U.S.C. § 102(b) Rejections

In the April 1, 2003 Office Action, claims 15-20, 25 and 40 were rejected under 35 U.S.C. 102(b) as being allegedly anticipated by Genov et al (US 5,064,340).

Genov et al disclose a precision arm mechanism which is useful for moving wafers, hard computer disks, and the like for processing, loading, unloading, etc. (see abstract, last sentence and column 1, lines 5 - 9). The arm has an end effector 32 having means for grasping the workpiece such as a silicon wafer or a computer hard disc (column 6, lines 40 - 41) Such an arm mechanism is also known as robot arm. The end

effector 32 is a hand of a robot which can be raised and lowered, moved forward and backward and turned. Generally, the arms have z, r and θ motion in a conventional cylindrical coordinate system (column 1, lines 12 - 14). The three types of motion can be characterized as follows:

θ-motion: The complete arm structure as shown in figure 2 rotates around the axle 24.

r-motion: The end effector moves along a straight line 34 at a selected angle to the line 34 (column 8, lines 44 - 48). It is a requirement that the angle of the end effector 32 relative to the lever seating the end effector does not change during this motion.

z-motion: The complete arm structure as shown in figure 2 is raised or lowered with respect to the plane of the drawing.

The invention of Genov et al. concerns the r-motion. Genov et al. disclose a new construction where the angle of the end effector 32 relative to the lever seating the end effector does not change during the r-motion.

The apparatus of the present invention as claimed in claims 15-40 is different from such a precision arm mechanism in many respects:

First, the present invention is directed to an apparatus for mounting semiconductors. The wording of claim 1 originally filed was: "A semiconductor mounting apparatus comprising...". During the prosecution of the application the wording was changed to "An apparatus for placing chips on a substrate comprising..." and finally received its current wording "An apparatus used as a component of a die bonder for placing a semiconductor chip on a substrate". Claim 15 is also directed to such an apparatus.

The apparatus of claim 15 is not the directed to a robot with an end effector which can be raised and lowered, moved forward and backward and turned. The apparatus of claim 15 does not allow independent movements like the r-motion and θ-motion. The apparatus only performs a movement from a first location to a second location, i.e. it performs a movement where the chip gripper is moved from one location A where it grasps a chip from a wafer table to another location B where it places the chip on a substrate. Thus the apparatus of claim 15 is not a robot but a simple transport system which transports semiconductors from a predetermined location A to a predetermined second location B. In the art such a transport system is also called a pick and place system.

In particular, note the wording of the introductory portion of claim 15: "An apparatus used as a component of a die bonder for placing a semiconductor chip on a substrate" clearly distinguishes from the precision arm structure of Genov et al. This already means that Genov et al. does not anticipate the claimed invention.

Second, the lever mechanism as claimed in claim 15 does not allow a θ-motion and an r-motion which can take place independent from each other but it enables a specific motion of the chip gripper from a first location A to a second location B. The motion of the chip gripper takes place using two levers. The invention consists in that the two levers are in an extended position with respect to each other when the chip gripper arrives over the first location A or second location B, respectively. There is a drive which actively rotates the first lever 10 whereas the second lever 12 is rotated with a predetermined gear ratio n relative to the first lever 10. The angle the first lever rotates is denoted with Φ. The gear ratio n is given by the equation $n = 360°/\Phi$ (page 3, line 2).

This means that the second lever 12 always makes a rotation of 360°, irrespective of the angle Φ. In the first embodiment shown in figures 1 and 2, the angle Φ is chosen as Φ = 180° and the gear ratio is 2: 2*180°=360°. In the second embodiment shown in figure 5, the angle Φ is chosen as Φ = 120° and the gear ratio is 3: 3*120°=360°. So when starting over location A with the two levers in an extended position with respect to each other, the two levers will arrive over location B in an extended position with respect to each other whereby the first lever will have been rotated for an angle Φ and the second lever will have been rotated for an angle of 360°.

This feature is defined in claim 15 as "a drive mechanism for rotating said second pivoted lever in an opposite pivoting direction and with a predetermined gear ratio with respect to said first pivoted lever, the drive mechanism coupling said first and second pivoted lever such that the second pivoted lever is in an extended position with respect to said first pivoted lever when the first pivoted lever is in said first end position or said second end position".

Genov et al. does not disclose this limitation because the robot arm of Genov et al is not limited to movements between two specific locations A and B. Instead the robot arm of Genov et al. can perform movements between any locations within a given working space.

Third, the robot arm of Genov et. al. does not only contain two levers, two toothed wheels and a belt or an intermediate toothed wheel, but it also contains more wheels and belts for keeping the orientation of the end effector 32 relative to the orientation of the second link. Furthermore it contains several housings. A result of this is

that the robot arm of Genov et al. is slow compared to the apparatus of the present invention which easily allows the huge number of 7200 back and forth movements between the locations A and B per hour.

Fourth, during the prosecution of this application, Applicant filed information disclosure statements containing the results of prior art searches conducted by the European Patent Office and the Australian Patent Office.

The European Patent Office classified the present application in the international IPC class H01L/00. The Australian Patent Office classified the present application in the international IPC classes H01L/ 21/58 and H01L 21/60. The patent of Genov et al. is classified in a quite different international class B25J 18/00. According to this classification, the pick and place apparatus of the present invention and the robot arm of Genov et al. belong to different arts. Applicant is of the opinion that the features "An apparatus used as a component of a die bonder for placing a semiconductor chip on a substrate" of claim 15 as well as "An apparatus for placing a semiconductor chip on a major surface of a substrate" of claim 40 reflect this difference in the arts and makes the claims 15 and 40 novel over the prior art.

Fifth, in an information disclosure statement, Applicant listed US 5,007,784 which is a continuation-in-part of Genov et al's US 5,064,340. US 5,007,784 contains method claims whereas US 5,064,340 contains apparatus claims. Figs. 4A to 4C of US 5,007,784 illustrate the working of the robot arm of Genov et al. These figures clearly demonstrate that the robot arm of Genov et al. does not make use of any extended positions for achieving a high positioning accuracy.

Applicant therefore respectfully traverses the U.S.C. §102(b) rejection of claims 15-20, 25 and 40 and submits that claims 15-20, 25 and 40 are allowable in view of the cited prior art.

The 35 U.S.C. § 103(a) Rejections

In the April 1, 2003 Office Action, claims 21-24 and 26-39 were rejected under 35 U.S.C. 103(a) as being unpatentable over Genov et al (US 5,064,340) in view of Parker (US 5,934,147).

The delimiters of the present invention are different from the delimiters of Parker in that the delimiters of the present invention guide the movement of the chip gripper 20 in the end positions Ea and Eb (page 11, lines 10-11). The delimiters are arranged laterally to the direction of movement of the chip gripper 20 (page 11, lines 15-17). The purpose of the delimiters is to prevent the swinging of the pivot lever 12' and the chip gripper 20 at their quick stops (page 11, lines 11-12). The purpose is not to serve as a stop as with Parker where the rotation delimiter 44 is arranged at the end of - and not laterally to - the movement path of the rotating head 22.

With regard to the gear ratio n, Applicant has explained above the meaning of the equation $n = 360°/\Phi$. It has been explained that the second pivoted lever always turns for 360° when the lever mechanism turns from the first location to the second location, i.e. it makes a full rotation on the axis of the shaft at the end of the first pivoted lever. The rotation angle of the first pivoted lever can be chosen and it is generally defined as Φ. With this in mind the gear ratio n can be calculated by means of the cited equation as $n = 360°/\Phi$. The gear ratio is therefore not a mere matter of choice but the gear ratio has to be calculated

according to a strict rule which rule is not known from the prior art as the prior art does not teach to use extended positions of two levers to achieve a high positioning accuracy.

Applicant respectfully traverses the U.S.C. §103(a) rejection of claims 21-24 and 26-39 and submits that these claims are not obvious and allowable in view of the cited prior art.

Further Comment

The apparatus of the present invention makes use of the concept that the first and second pivoted lever are in extended positions with respect to each other when the first pivoted lever is in its first end position or its second end position where it points to the first or second location, respectively. During the examination procedure some of the prior art has been discussed. The prior art contains other robot arms or placement systems which have been disclosed during the prosecution of this application but not discussed so far. Applicant is of the opinion that the prior art of record does not show any apparatus constructed according to the concept of extended positions of two levers. Therefore, Applicant is of the opinion that the claims 15-40 are novel and involve an inventive step over the prior art on record.

Request for Entry of Amendment

Entry of this Amendment will place the application in better condition for allowance, or at the least, narrow any issues for an appeal. Accordingly, entry of this Amendment is appropriate and is respectfully requested.

Request for Allowance

As each of the Examiner's rejections have been addressed herein, early favorable consideration of this Amendment is earnestly solicited and Applicant requests that the Examiner enter this amendment and pass claims 15-40 to issue.

If, in the opinion of the Examiner, an interview would expedite the prosecution of this application, the Examiner is invited to call the undersigned attorney at the number indicated below. The Commissioner is hereby authorized to charge any additional fees or credit any overpayment to Deposit Account No. 50-1698.

Respectfully submitted,

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